A World-Class Program

It is said that if you give a man a fish you feed him for a day, but if you teach him to fish you feed him for a lifetime. In the spirit of this adage, the International Training and Research in Environmental and Occupational Health (ITREOH) program trains health scientists, clinicians, epidemiologists, toxicologists, engineers, industrial hygienists, chemists, and allied health workers from developing countries in the skills they need to maintain environmental and occupational health in their countries both now and in the future.

The ITREOH program is supported through grants from the Fogarty International Center (FIC) of the National Institutes of Health, made possible by joint support from the NIEHS, the National Institute for Occupational Safety and Health, the National Center for Environmental Health, and the FIC. According to Joel Breman, deputy director of the Division of International Training and Research at the FIC, ITREOH projects, because they are training grants, include only an 8% overhead; the rest of the money invested by partner institutes goes directly toward research training costs (the typical overhead for research grants runs as high as 50%).

As part of the ITREOH program, the NIEHS funds 13 researchers through its Division of Extramural Research and Training to conduct studies in program trainees' home countries. Such studies help trainees attain master's or Ph.D. degrees or complete some other research training program. They also form the basis for long-term research collaborations that may be funded in the future by additional grant monies.

The program supports both long- and short-term training, which may include coursework at U.S. institutions leading to advanced degrees for individuals both with and without previous field research experience; comprehensive courses given in either foreign countries or the United States; training in laboratory procedures and research techniques related to environmental and occupational health; and postdoctoral research training for foreign scientists.

The ITREOH program also aims to increase the laboratory skills of foreign technical assistants as well as expand ongoing collaborative training and research in environmental or occupational health between U.S. and foreign scientists. In doing so, the program provides advanced research training for selected current and former trainees to enable them to continue this advanced training and to participate in research projects in their home countries.

Since its 1995 debut, the program has provided support for over 200 trainees to complete degrees, has sponsored over 100 foreign training courses, has placed over 4,400 trainees in the field, and has put about 200 U.S. faculty in place in the United States and abroad. A total of 234 publications and 285 presentations have come from the work done by participating scientists and trainees during this period. The program currently sponsors collaborations with 28 nations in Central and South America, Asia, Africa, and Europe.

The Americas

The Southwest Center for Occupational and Environmental Health at the University of Texas in Houston, under the direction of George Delclós and Sarah Felknor, has established collaborative agreements with institutions in Venezuela, Mexico, Colombia, and Costa Rica. In addition to intensive training programs in these countries, the center offers graduate training at the master's and doctoral levels to students of occupational and environmental health with an emphasis on epidemiology, environmental science, management, and industrial ergonomics and safety. There are five full-time graduate students currently enrolled in the University of Texas program, with two in the research phase of their training.

Doctoral student Laura Freimanis-Hance is studying the seasonal patterns of rotavirus-associated diarrhea in children under the age of two who have been hospitalized for the condition. The research is a case–control study of patients from a hospital in Valencia in the Venezuelan state of Carabobo. According to a study by Irene Perez-Schael of the Universidad Central de Venezuela in Caracas that was published in the September 1996 supplement to the *Journal of Infectious Diseases*, an estimated 1,320,000 childhood diarrhea episodes occur annually in Venezuela, which breaks down to 2.2 episodes per child per year. According to the article, rotaviruses are the most common cause of pediatric consultation for diarrhea in Venezuela, occurring in 17–50% of diarrhea cases in children under two years of age who seek hospital care.

Freimanis-Hance is collecting samples in the hospital and interviewing the mothers of the sick children. Data collection will span a full 12-month period to check the seasonality of the condition. Although data collection is only about half-completed, the researchers predict the disease will prove to be associated with Venezuela's cool season of November through February.

Another study funded by the Southwest center is being led by graduate student Silvia I. Maberti, who is studying the use of the metabolites *trans-trans* muconic acid and s-phenylmercapturic acid as biomarkers of exposure to benzene. Benzene, a known human carcinogen, is used as a solvent and cleaning aid and is also present in gasoline and cigarette smoke. Many Venezuelans receive substantial occupational exposures to benzene through work in the petroleum industry, which accounts for over 75% of the country's export earnings. The results of this study will provide information on the urinary excretion patterns of the metabolites and may result in a sample-gathering strategy for testing Venezuelans' exposure to benzene.

Asia

Scott Barnhart, director of the Occupational and Environmental Medicine Program at the University of Washington in Seattle, and colleagues in the Vietnamese National Institute of Occupational and Environmental Health are studying the occurrence of silicosis and other forms of pneumoconiosis among Vietnamese mine workers. The pneumoconioses are a family of lung diseases caused by inhaling mineral dust particles. Commercially exploitable metals and minerals found in Vietnam include coal, quartz, iron, copper, chromite, tungsten, mica, and limestone. In Binh Dinh Province, where much of Barnhart's work is being done, the granite mountains yield great amounts of crushed stone, but health hazard controls are very low.

According to a 1997 World Health Organization (WHO) fact sheet on occupational health, silicosis is the most widespread progressive occupational lung disease in the world. Barnhart says silicosis is an exposure of global concern, but particularly in developing nations, where rapid development calls for large quantities of crushed stone and other materials for projects such as road construction. There were approximately 9,000 cumulative cases of silicosis in Vietnam between 1978 and 1997, according to figures published by the Vietnamese Ministry of Health. An estimated 260,000 workers are exposed to dust levels having a high content of free silica and are therefore at high risk for silicosis. A 1995 WHO white paper titled *Global Strategy on Occupational Health for All* states that as

many as half of all workers who are most heavily exposed to silica dust may develop some form of pneumoconiosis.

The University of Washington project focuses on providing training in Vietnam for physicians on how to conduct risk surveys for silicosis and on primary and secondary prevention of silicosis. The university also provides hardware and software as well as training to help Vietnamese scientists set up geographical information systems for analyzing the spatial relationships between exposure to silica dust and characterization of occupational health hazards. In addition, Vietnamese faculty who visit the University of Washington bring data from their country to be analyzed in the United States.

Says Barnhart, "Within Vietnam there is an extensive work group that includes the National Institute of Occupational and Environmental Health, the Ministry of Health, other key ministries such as the ministries of industry, labor, and construction, and international partners all working to develop a systematic approach to silicosis control." Toward that end, developments over the past year have included data collection from Vietnam's 61 provinces on silica risks, number of workers exposed, and identified cases of silicosis; completion of a preliminary risk assessment in Binh Dinh Province, where several cases of acute silicosis recently appeared; design of a two-part course on using chest radiographs to conduct pneumoconiosis surveillance; and provision of a laboratory-based course on risk surveys using exposure assessment of dust, in which participants conducted exposure assessments at three different industrial sites.

Africa

Under a partnership between the University of Michigan Department of Environmental and Industrial Health in Ann Arbor and the University of Cape Town in South Africa, doctoral candidate Mohamed F. Jeebhay is studying occupational asthma and allergy among South African seafood workers. With approximately 28,000 employees, the seafood industry is important to the economy of South Africa's Western Cape Province. Jeehhay and colleagues surveyed nearly three-quarters of the seafood companies in the Western Cape to ascertain the type and occurrence of work-related allergic health conditions. They found that some 50% of the companies had diagnosed occupational diseases among workers in the past year.

The predictors of sensitization and other health outcomes associated with lobster and bony (or chordate) fish are not well understood. According to Thomas Robins, an associate professor in the Department of Environmental and Industrial Health at the University of Michigan and chairman of Jeebhay's thesis committee, the reported prevalence of seafood-related allergy among seafood workers is as high as 35% in some studies. It is believed that allergens are aerosolized through various processes involved in the gutting, cooking, packing, and freezing of seafood. These aeroallergens are believed to be responsible for such allergic responses as occupational asthma, watery eyes, sneezing, and dermatitis. Jeebhay is focusing on defining how the seafood allergens become aerosolized, as well as identifying mechanisms of sensitization.

Also under the auspices of the Fogarty program, Jeebhay cowrote a chapter on occupational asthma for the Allergy Society of South Africa's *Handbook of Practical Allergy*. In the handbook, Jeebhay and coauthor Rodney Ehrlich of the University of Cape Town place the occurrence of occupational asthma in all occupations at 2–15% of all workers, a figure reflected in most industrialized nations. Sensitizing agents that can lead to occupational asthma include organic dust (wood, grain, and tobacco); isocyanates; vapors and fumes of formaldehyde, anhydrides, amines, and diamines; metals such as platinum and nickel; soldering and welding fumes; hardening agents such as epoxy resins, acrylic acid, and acrylates; substances of animal or insect origin; fungi and spores; and proteolytic enzymes.

Europe

Daniel Hryhorczuk is director of the Great Lakes Center for Occupational and Environmental Safety and Health at the University of Illinois at Chicago. Through the Fogarty program, the center is conducting studies in Ukraine, Belarus, and Lithuania. One of these studies, the prospective, geographically based Family and Children of Ukraine Study, is a collaborative effort between the center and the Ukrainian Institute of Pediatrics, Obstetrics, and Gynecology to study the effects of the environment on the health of mothers and children.

Ukraine has 52 health research institutes. Once regarded as centers of excellence in the areas of environmental and occupational health, these institutes have suffered a severe reversal of fortune due to the economic crisis resulting from the breakup of the former Soviet Union. Hryhorczuk hopes the U.S.–Ukrainian partnership will help these institutes regain their former stature.

The Family study, initiated in 1991, is part of the WHO's European Longitudinal Study of Pregnancy and Childhood. In 1992, 8,000 pregnant women were recruited from five Ukrainian cities. The study followed the women's pregnancies and will track the cohort of births through age seven. In 1995, the study was picked up by the Great Lakes Center as part of its Fogarty program.

Training conducted in association with the Family study includes long-term graduate school education of Ukrainian students and short-term training of Ukrainian visiting scientists within the United States. Visiting scientists complete up to four months of research training in the United States through working with U.S. collaborators on joint research projects. For example, one visiting epidemiologist was able to complete a nested case–control study of macrosomia (a condition common among babies born to mothers with gestational diabetes) from births in the Family study cohort. Training also includes conferences, workshops, seminars, and symposia in Ukraine, including the 1996 symposium "Reproduction and the Environment" and the 1997 research workshop "Public Health Consequences of Environmental Pollution."

To assist in processing the data generated by the Family study, the Great Lakes Center established the Data Management Center in Kiev. This center is staffed by Ukrainian data management workers and medical practitioners, and provides an important training resource for young scientists just beginning their careers.

The Best of Both Worlds

The ITREOH program is now at the midpoint of its fourth year, with new plans afoot for training scientists in laboratory research, epidemiology, environmental monitoring, workplace risk assessment, engineering controls, and disease prevention and control. As health conditions such as silicosis and asthma continue their rise in industrialized nations, mutually advantageous international collaboration continues to be the only natural choice. By combining the resources of the United States' major public health players with the some of the most promising rising scientists from collaborating countries, the FIC is laying the groundwork for a healthier future for the world.